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(54) **Steam generator with improved injector**

(57) Steam generator comprising a hollow body (10) into which the water is let via a conduit (16) that penetrates therein by passing through the wall opposed to the one that carries a heating element (14).

The conduit (16) extends into the interior of the generator with an injector (21) that reaches up to a point

close to the wall carrying said heating element (14) and the inner surface of said injector is protected by a lining sheath (22) of a polymeric material.

The solution enables scale forming at the extremity of the injector, as well as in the interior thereof, to be reduced to a considerable extent.

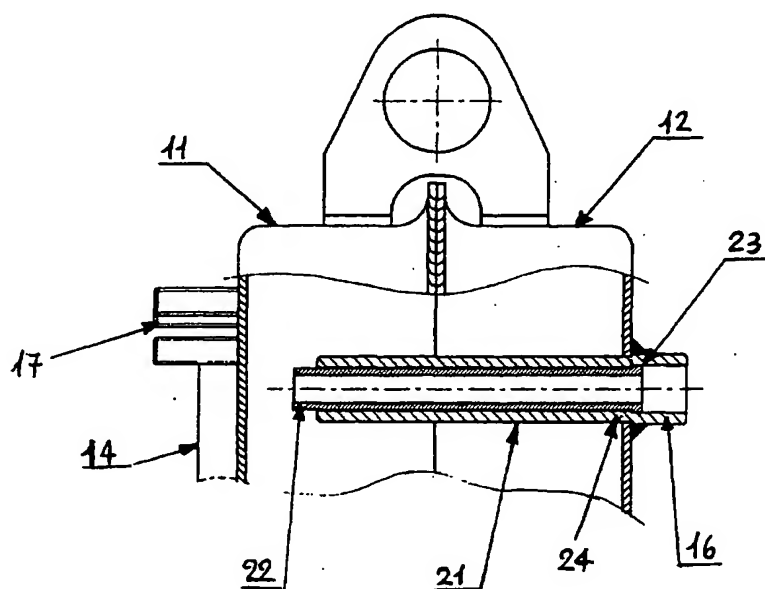


FIG. 2

Description

[0001] The present invention refers to a steam generator, which is suitable for use in a number of different applications, such as for instance steam cleaning machines, clothes irons, fan-assisted or suction-type ironing boards with refill function, coffee brewing and similar machines, and namely such a steam generator provided with an improved water injector.

[0002] EP-A-1 026 306 in the name of the same Applicant discloses a so-called vertical-axis steam generator, into which the water is let via a conduit that extends through a side wall of the steam generator in a horizontal direction. The water is let under pressure into the interior of the steam generator in such a manner as to enable it to practically hit against the opposite side wall, in a zone that corresponds to the one in which the thermostat controlling the operation of the generator is actually situated.

[0003] The steam generator described in the above cited European patent publication is certainly advantageous, since it enables both the amount of water supplied to the generator and the steam generation rate or rapidity to be varied. Furthermore, the particular arrangement of the electric heating elements on the vertical side walls of the generator enables the power output of the generator itself to be varied, up to a doubling thereof in view of heavy-duty, industrial applications of the generator.

[0004] However, such a kind of steam generator may show some drawbacks when it is supplied with water that is very rich in mineral salts, ie. with a high content of mineral salts. In fact, limestone tends to form in these cases, particularly at the extremity of the water injector and even in the interior thereof. Such a scaling effect tends to accumulate, ie. build up, and, after a certain number of cycles of operation of the steam generator, may even cause the water inlet in the generator to eventually become clogged. The need therefore arises here for cleaning operations to be planned and carried out periodically, and these cleaning operations are rather difficult and certainly quite awkward to carry out, since they call for the generator to be first emptied and then treated under utilization of special substances adapted to dissolve the so formed limestone.

[0005] It therefore is a main purpose of the present invention to do away or at least drastically reduce the above mentioned drawback, so as to enable the steam generator to be used throughout prolonged periods of time without any need arising for troublesome maintenance operations to be carried out in view of removing the scale affecting the water injector and, therefore, the steam generator itself.

[0006] This aim has been reached, as the result of successive experiments, in a steam generator in which the water supply conduit extends into the interior of the generator with an injector that reaches up to a point close to the wall carrying the heating element, wherein

the inner surface of this water injector is protected with the use of a lining sheath of polymeric material, as this is recited in the appended claims.

[0007] Features and advantages of the present invention will anyway be more readily understood from the description that is given below by way of non-limiting example with reference to the accompanying drawing, in which:

- 10 - Figure 1 is a schematic view of a steam generator according to the present invention; and
- Figure 2 is a partially sectional view of a detail of the steam generator illustrated in Figure 1.

[0008] The steam generator according to the present invention illustrated in the Figures is constituted by a hollow body 10 in the shape of a parallelepiped, which is arranged with its major axis substantially vertical, and which has side faces having a larger surface than the upper and bottom bases thereof.

[0009] The hollow body 10 is formed by two half-shells 11 and 12 which are joined to each other along the peripheral edge 13 thereof. An electric heating element 14, duly provided with terminals 15 for the connection thereof to the power supply line, is attached to at least one of the side faces of the body 10. The water is let into the interior of the hollow body via a conduit 16 which penetrates thereinto in a substantially horizontal direction by passing through the wall on the opposite side of the wall carrying the electric heating element 14.

[0010] On the electric heating element 14 there are mounted a thermostat 17, which controls the energization, ie. operation of the water-supply pump (not shown), and possibly a further safety thermostat 18.

[0011] The steam generated inside the generator 10 is delivered to the steam-using apparatus (cleaning machine, steam iron or the like) via a conduit 19.

[0012] According to the present invention, the water supply conduit 16, which passes through the wall of the half-shell 12, is made out of metal tubing, preferably a stainless-steel pipe, and extends into the steam generator with an injector 21. The conduit 16, and therefore also the injector 21, is normally welded on to the wall of the half-shell 12. The injector 21 is arranged in a substantially horizontal direction and the internal extremity thereof terminates at a short distance from the wall of the opposite half-shell 11. In this manner, the sensitivity and responsiveness of the thermostatic control of the steam generator are enhanced, with the advantages that have already been described in EP-A-1026306.

[0013] Again according to the present invention, in view of preventing limestone, ie. scale from forming both in correspondence of the extremity of the injector 21 and in the interior thereof, the inner surface of the injector is protected with the use of a lining sheath 22 of a polymeric material. In particular, such a lining sheath 22 is made of a thermosetting polymer.

[0014] Experimental tests have demonstrated that, among the most suitable materials for this kind of application, the currently preferred one is a silicone ensuring a smooth surface and a heat resistance of at least 250°C. This material furthermore features excellent heat and electric insulation properties, along with a marked water-repellent and non-stick capacity.

[0015] The lining sheath 22 may be applied using any practicable means known in the art, although the solution that actually seems to be the technically most simple and advantageous one is constituted by the insertion in the injector 22 of a lining sheath in the form of a tubule 22.

[0016] In view of improving the anti-scaling effect at the extremity of the injector, the tubule 22 is allowed to slightly protrude from the internal extremity of the same injector. At its extremity facing the conduit 16, the tubule 22 has an annular collar 23 that enables it to abut against a corresponding inner prominence 24 of the injector 21. This makes it much easier for the tubule 22 to be inserted and properly arranged inside the injector 21, while preventing the same tubule from possibly slipping out owing to the action of the supply pressure of the water.

[0017] The above described innovatory solution has been illustrated in connection with a steam generator of a vertical-axis type, into which the water is let via a conduit that penetrates therein in a horizontal direction through a side wall of the generator. However, anyone skilled in the art will readily appreciate that this solution may be advantageously applied to steam generators of any type, even horizontal-axis or inclined-axis ones.

jector (21).

5. Steam generator according to claim 4, **characterized in that** the tubule (22) is allowed to slightly protrude from the internal extremity of the injector (21) and is provided with an annular collar (23) at its extremity facing the water-supply conduit (16) so as to be able to abut against a corresponding prominence (24) provided inside the injector (21).

Claims

1. Steam generator comprising a hollow body (10) into which the water is let via a conduit (16) that penetrates therein by passing through the wall opposed to the one that carries a heating element (14), **characterized in that** the conduit (16) extends into the interior of said hollow body (10) with an injector (21) that reaches up to a point close to the wall carrying said heating element (14), and that the inner surface of said injector (21) is protected by a lining sheath (22) of a polymeric material.
2. Steam generator according to claim 1, **characterized in that** said lining sheath (22) is made of a thermosetting polymer.
3. Steam generator according to claim 2, **characterized in that** said lining sheath (22) is made of silicone.
4. Steam generator according to any of the preceding claims, **characterized in that** said lining sheath (22) is constituted by a tubule inserted into said in-

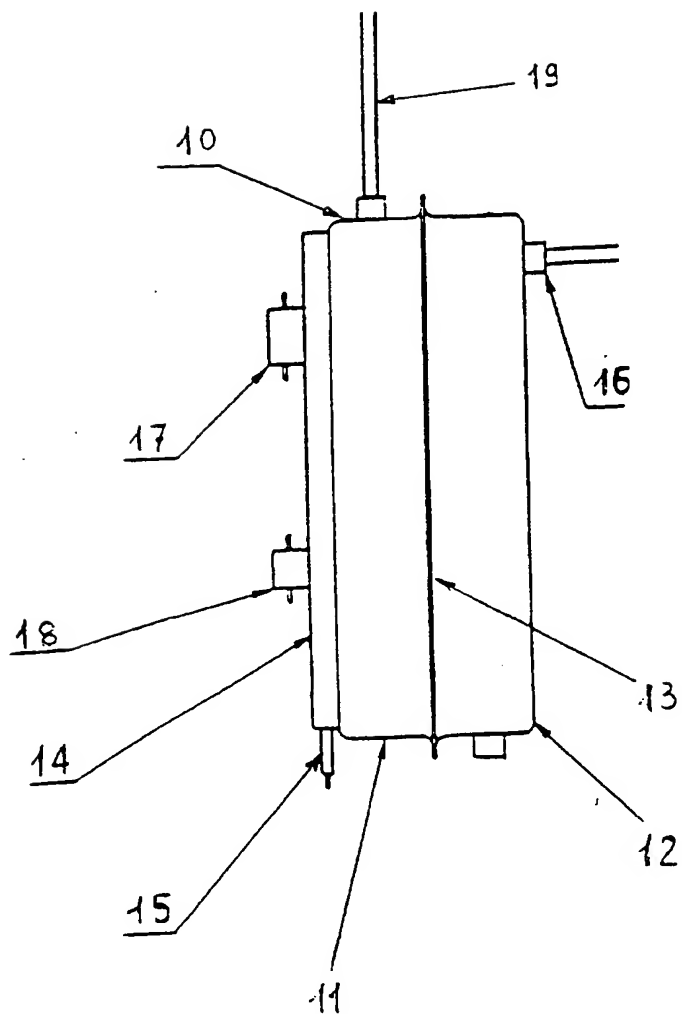


FIG. 1

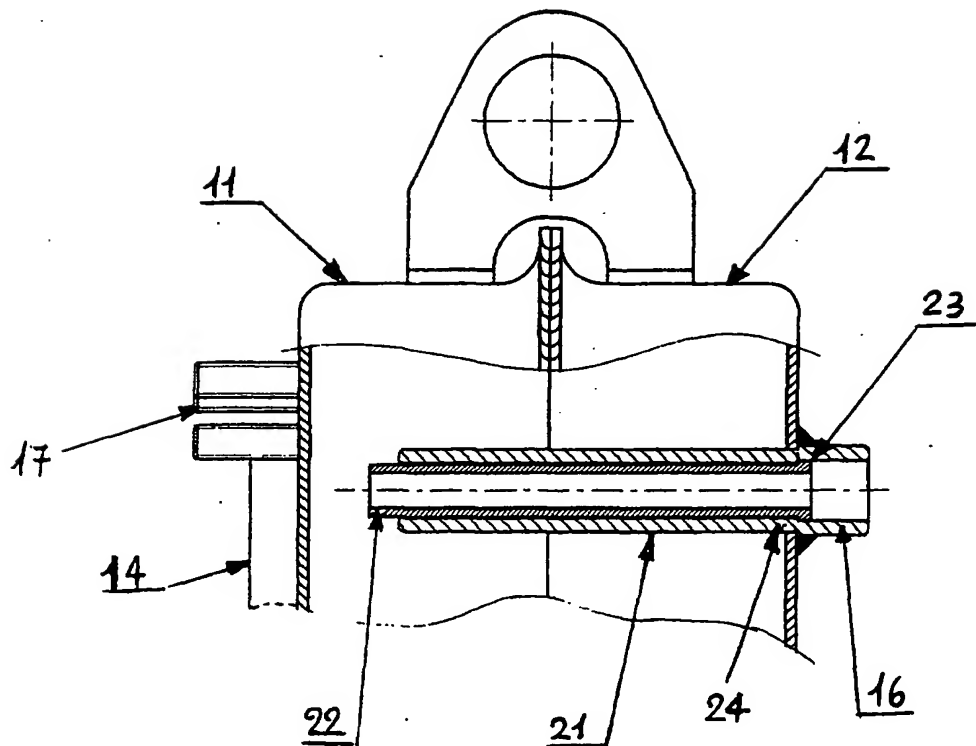


FIG. 2



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 01 12 3966

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	US 4 578 563 A (EGUCHI KENZO ET AL) 25 March 1986 (1986-03-25) * column 2, line 12-28 * * column 3, line 4-20 * * figure 2 *	1-3	F22B1/28
A	EP 0 638 684 A (MOULINEX SA ; ESSE85 S R L (IT)) 15 February 1995 (1995-02-15) * column 2, line 2-13, 20-29 * * column 3, line 2-15 * * figure *	1	
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			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			F22B D06F
The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 6 December 2001	Examiner Novelli, B
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>I : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>			

EPO FORM 1503 03/02 (P04001)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 01 12 3966

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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